datacolor

Spyder5 eBook

Color Management Can Be Easy

Quick facts for photographers and videographers

Foreword

What is color management?

You are probably familiar with color management if you've spent time on photography or videography. We often notice the absence of color management in everyday life. We have all taken pictures, ordered prints and noticed that they have a flaw, like a green cast. "That's not what it looked like when I shot the photo!" is the most common reaction. Nobody wants unattractive skin tones; not in the their personal photos, and certainly not in a professional ones, such as portrait and wedding photos.

Color Management is technology designed to minimize color and brightness inaccuracies.

How does the color discrepancy between perception and print arise?

To understand color management, you first need to take a closer look at the properties of light. White light consists of all of the colors of the visible spectrum. As the composition of light changes, it's color temperature changes. For instance, there are more reds in the evening sun than in the midday sun, where the colors have a much more balanced ratio. That means a white sheet of paper should have a warm, neutral, or cool look at different times, but that is not always the case.

What about human vision? The retina of the eye, which is quite comparable with the sensor of a camera, perceives these color differences and redirects these signals to the brain. The brain analyzes this data and completes a white balance based on recent sensory experience. As a result, the sheet of paper mentioned above would then appear white in all cases. This phenomenon is called color constancy.

People also perceive colors at different brightness. Our brains perceive an image that differs from what's actually present. This explains the green-tinged photo: it was probably taken in fluorescent light, and imaging devices do not have the correction techniques of human vision to counteract this.

Color management can reduce this problem

To a certain extent, color management attempts to simulate the brain and corrects the raw data coming from the sensor in order to match the feeling of human perception more closely. Color management can do even more than just that. While a human being represents a closed system (more or less), where everything is finely tuned, this is not the case with modern technology. We combine input devices (camera, smartphone, etc.) and output devices (monitors, printers, etc.), without considering that each device has a different range of capabilities to capture or display colors. Different papers also have their own reflective properties in prints. All devices must be coordinated with each other to prevent any unpleasant surprises. This is why color management is necessary to achieve consistent color across devices and outputs.

Our eBook provides compact and practice-oriented information to answer the question, “What do I have to keep in mind to coordinate color across my workflow?”

1 Understanding digital color

The basics of color management

- Which color measuring instruments you need for color management
- How the digital color world works
- Why you should work with RAW data

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Color Management Using Colorimeters

Why use color management equipment?

High-quality color control that is time- and cost-efficient is almost impossible to achieve without color management tools. Anyone who has ever set up their printer for fine art prints and has ended up using an entire ink cartridge and a lot of high-quality paper for test prints will understand this. The concept of color management involves coordinating systems so that once taken, the image on the output side (monitor, printer or other output device) appears as close to the original as possible. This also includes deliberate changes made to image content. In other words, photographic editing needs to be reproduced on the output side as it was carried out on the monitor. Why? Depending on the make and model, digital cameras have different color characteristics that can be corrected using a color calibration tool. What's more, lenses can also introduce color traits, while low-quality lenses even create clearly visible color casts and light falloff. These can be almost impossible to modify.

We can, however, influence the appearance of the digital image on the display. Without corrections, we also see an interpretation of the image that may not be representative of its true colors. This is determined by the electronic components of the display and its age. It gets trickier when it comes to printing images on paper. When we convert the light colors, which have determined the process so far, into printing inks, it can involve distortions and limitations.

The eye is not enough

In short, we are moving between physical worlds of color. We can work with several devices, which each individually interpret the colors for us. If you rely solely on the expertise of your eye and make adjustments according to your vision, you will very quickly reach your limits. Every additional device included in a color workflow will heighten the complexity. To add to this, color variations don't behave in a linear fashion, but differ according to saturation level and the shade of color.

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This article gives a good overview on how human vision works

More Info >

Finally, it is important to keep in mind the color constancy phenomenon. You'll notice how fast your eye compensates for color casts, such as when you change the color profile on your monitor. Our brain adapts for the brightest white in the field of vision. This phenomenon is called color constancy. It means we can't trust our eye to tell us if a display is neutral, as our brains may have "neutralized" it for us.

Sample representation of color temperatures: An image with daylight lighting (6500K), fluorescent, and incandescent lighting.

INTERESTING ONLINE FINDS

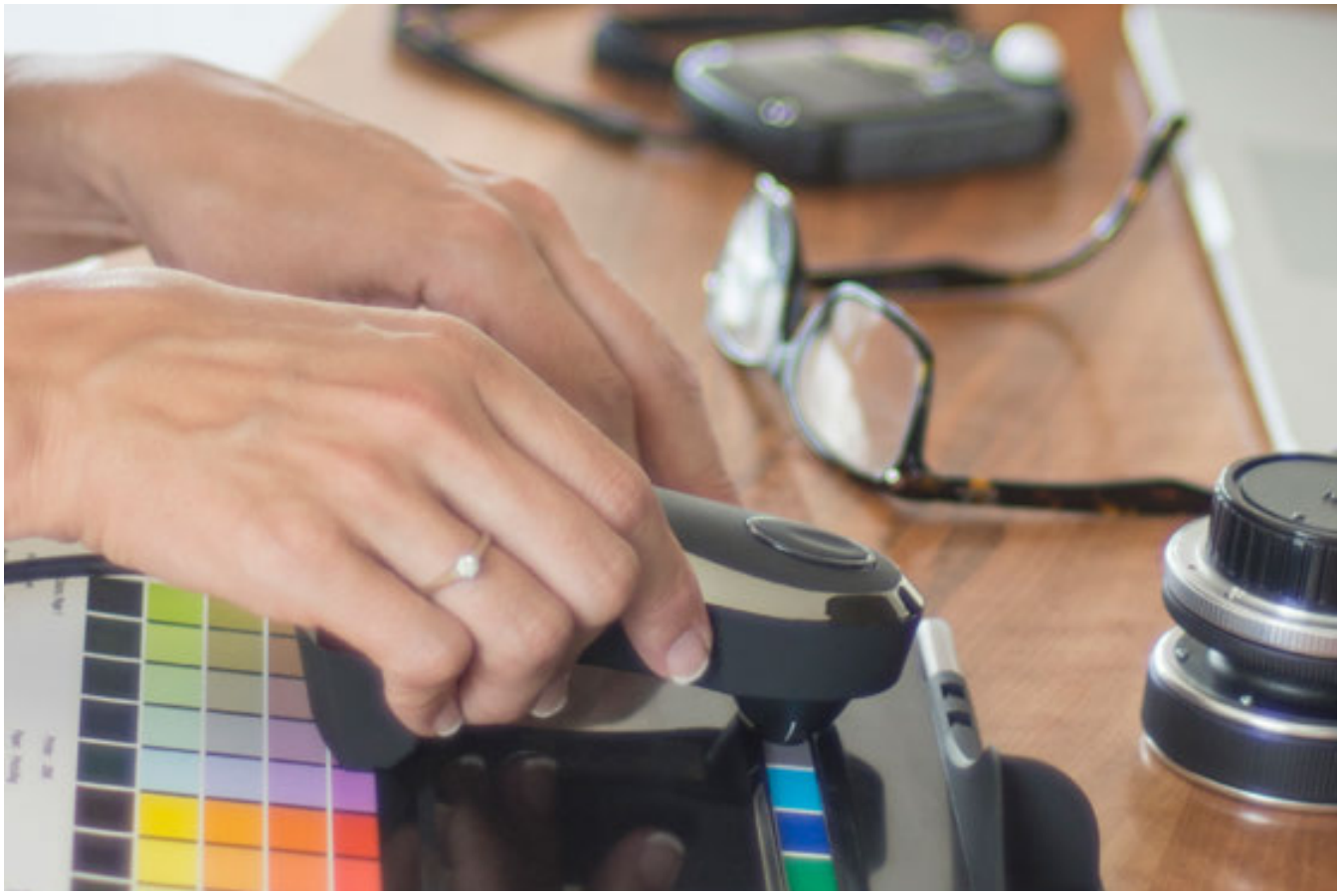
The subject of color, our perception of it and its various interactions with our total health is covered within this article

More Info >

Additional benefits of hardware-based color management

Some lab professionals – especially in the realm of black and white photography – might manage to color match a monitor and printer without any measuring devices. Yet even viewing digital data on another workstation or outputting images on a different printer will produce unpredictable results. The resulting image usually won't resemble the one the photographer intended to create.

Money spent on test prints would be better invested in an affordable monitor calibration device that works to color standards with other devices, rather than a closed system. The lab tech would also have the option to give his or her data to a print service provider afterwards. This wouldn't be possible if they kept to their non-color managed workflow, because the settings are device-specific and aren't standards-based.



The calibration tool for inks in action: SpyderPRINT compares the printed colors with the reference colors, calculates color differences, and compensates for them.

TIP

It is wiser to leave the measurement of colors to devices designed for this purpose. These, unlike the eye, are objective, and now there are reliable devices available for an affordable price.

More Info >

What kind of equipment is necessary for color management?

You need two electronic devices for color management: a calibration device for the light colors of the monitor, and a profiling device for the material colors of the prints. Depending on the manufacturer, the devices are designed either for CMYK offset printing or an RGB workflow. For an explanation about the differences between CMYK and RGB, see the section “Color models” on page 16.

Spyder5 measures the colors on the display, corrects these to reference values and adjusts brightness before creating an ICC profile.

INFO

Videographers, too, will enjoy the benefits of color management: with the Spyder5ELITE you can analyze more than just the quality of the monitor. Special calibration targets for videographers are easy to use. An interactive help window makes it easy for beginners, as well.

More Info >

What ICC Profiles Do

An ICC profile (also called a color profile) is a device-independent standardized data set that describes the color space of a color input or color output device, such as a monitor or a printer. Standardization is necessary for using an open system to allow any two devices to be used together with proper color correction from one to the other.

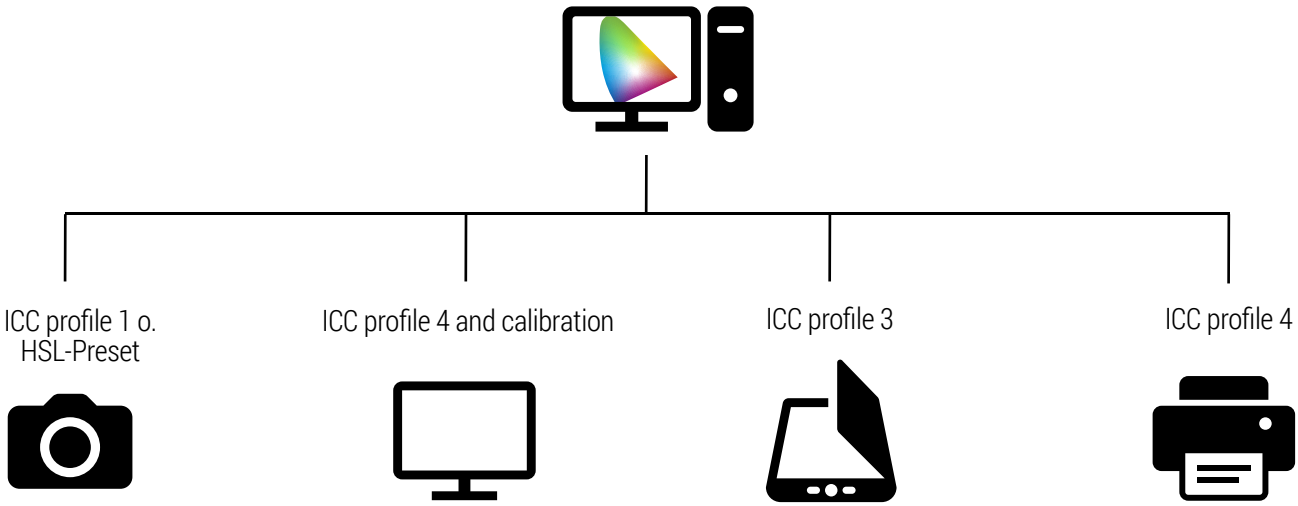
Without ICC profiling, different displays will reproduce the same image with different results.

What an ICC profile is and how is it used

But it's not merely the description of the color space alone:

"An ICC profile is (...) used to describe the properties of a device
for capturing and playing back color
to allow for compensation of errors during color reproduction."

This definition by Andreas Kunert (from: Color management in digital photography, Bonn 2004) illustrates the principle of the ICC-based color workflow.
This color workflow works as follows:



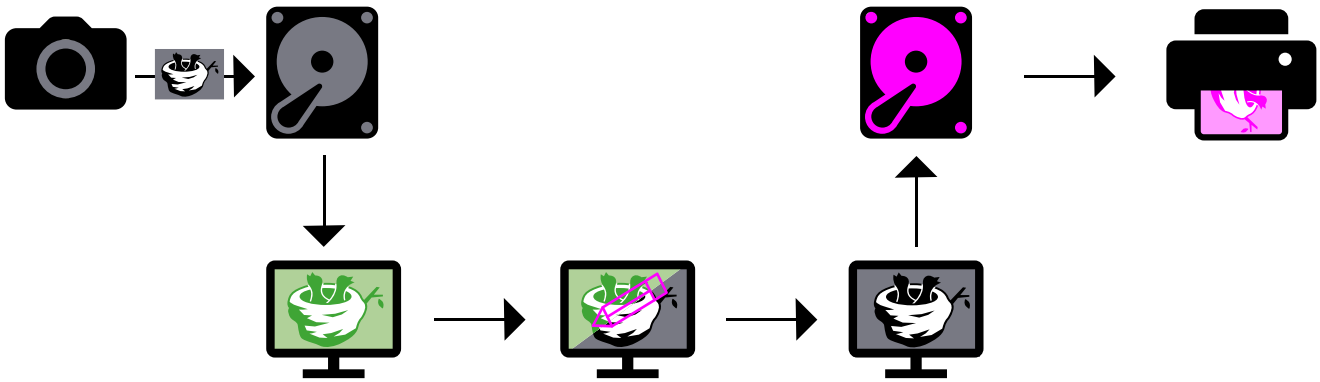
For all connected capture and playback devices (i.e. cameras, scanners, monitors, printers or projectors) - individual ICC-profiles are created. Alternatively, with capture devices, balance tools and HSL-presets can be used.

The color management system now carries out corrections based on the common framework. For example, an image may need to be transferred from one color space to another, like from a monitor screen to a printed image. In this case, so-called gamut mapping is carried out, where the colors of the larger monitor or camera color space are conveyed to the smaller printer color space. This process is done using a choice of rendering intents.

INFO

The ICC standard has now reached version 4.3. You will find more information on the Internet at **www.color.org.**

More Info >



Error chain in a non-calibrated system: A neutral color image is corrected in an image processing program on a non-calibrated, green-tinged monitor by adding magenta for neutrality on-screen. Once saved, the previously correct image file that was represented incorrectly on the monitor would now contain incorrect values. The result would be prints with a magenta cast.

Why regular profiling is necessary

Unfortunately it is not enough to profile every device once and to then use it in any situation.

- **Digital cameras** must be matched with multiple profiles or HSL-settings in the RAW converter for lenses with different color casts.

- **Monitors** shift out of alignment over time. Regular profiling is necessary to ensure that the color temperature is constant and the color channels remain coordinated. The brightness settings of the display need to be adjusted before starting the profiling process.

- **Printers** are subject to continual wear and tear, which changes their printing characteristics. The printable color space (gamut) is, however, chiefly dependent on the paper and ink used. This makes it necessary to set printer profiles for every paper/ink combination, and to update if the inks or paper chemistry changes.

Framework

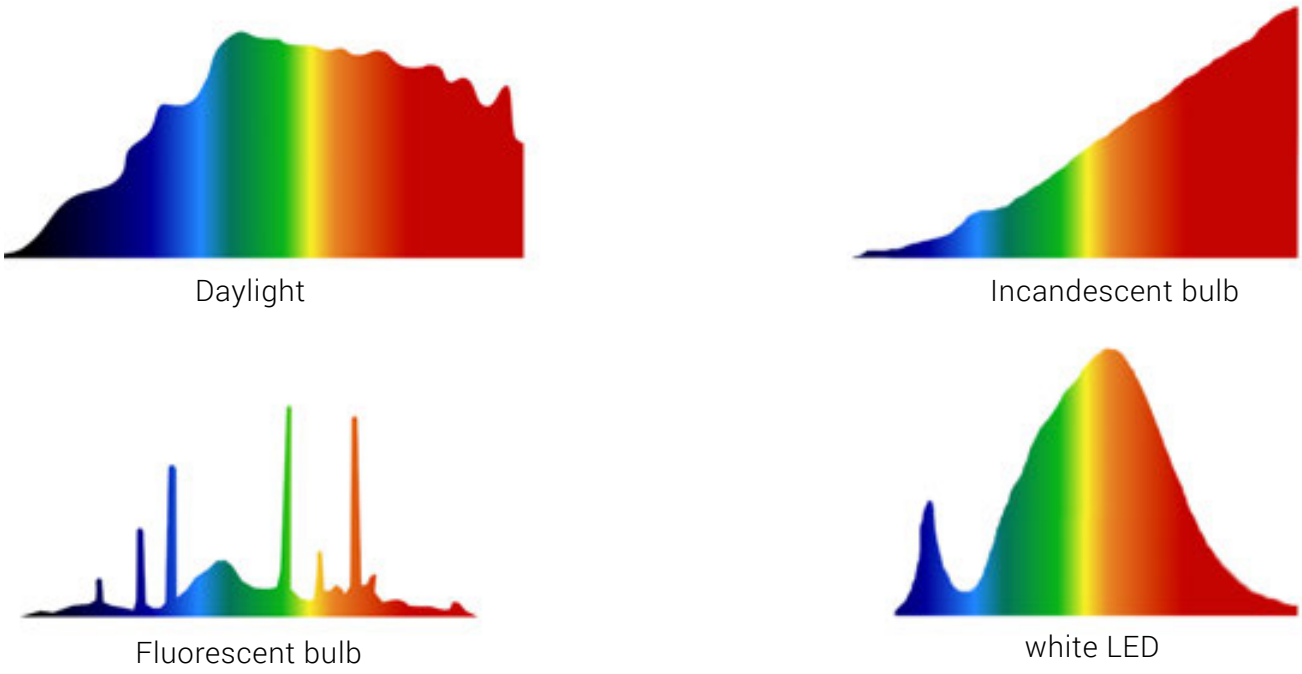
Improving the technical quality of color profiles

Important: Don't be alarmed by reduced contrast or saturation on screen while working with color profiles. The goal of profiles is to reproduce colors as they appear in the source file to improve the color accuracy. A highly saturated color display can cause an image to seem dull, or contrast can seem low, in favor of enhanced highlight and shadow detail.

Why is this so? Anyone who has ever compared different computer monitors or televisions in a showroom will know that these devices compete for attention using exaggerated brightness, color saturation, and contrast. Reproducing content as realistically as possible is not the goal, selling displays is. New displays continue to offer ever-higher brightness, making them seem more desirable than older screens. When these screens are calibrated and standardized using a color management system, they then exhibit more accurate, but less punchy, color.

This allows the user to objectively assess the actual color and brightness of an image. If the artistic intent is high contrast and saturation, it can now be added to the file, where it will reach the print, which the punch provided by a display in show-room-mode would not.

Printers, on the other hand, need correcting due to their limited color capabilities. With cameras, there is yet another significant aspect: scene lighting. Things get more complicated here as attention needs to be paid not only to white point, but to an entire spectrum of light that can vary in its composition.



Light sources have a whole range of spectral compositions and, as a result, different color characteristics.

How to master the color perils of everyday life

In reality, there are other complications. These come about due to the automatic, in-camera editing of the capture, and image editing on the computer by the user. That's why, when photographing in JPEG format, you need profiles for the assorted camera settings and specs for handling color profiles when opening the images. If you work with RAW photos, a highly flexible RAW workflow is added.

The aim of working with ICC profiles is to get the same color results on different output devices. In most cases, the colors displayed should represent the smallest color space in the workflow.

EXPERT INSIGHT

How ICC profiles came about

The acronym ICC refers to the "International Color Consortium," a panel dealing with digital color hardware and software manufacturers. The starting point of the consortium was an invitation from FOGRA in 1992, at which they wanted to shape the future of color communication in open computer systems.

At that time, there had already been color management solutions. However, the use of "open systems," allowing a variety of devices from different manufacturers, was new in print media production. Before DTP took over prepress, at the beginning of the digital age in the 80's, work was done with closed systems whose components were all supplied by a single manufacturer. Lack of competition allowed these products to be expensive, but they were also inflexible. Many offered no way to export files. The first ICC standard was published in 1993, based on, but improving, Apple's original ColorSync system. The device-independent description of color for different components was forward-thinking, and very successful.

ICC in Practice

What should be considered?

There are many issues and challenges in the world of digital color, such as choosing profiles for various purposes. The problems usually start when users set their custom monitor profile as the RGB working space in Photoshop. Not only does this configuration not solve color issues, it actually makes them worse.

One should differentiate three areas of color management before the practical use of ICC profiles: **color model**, **color space** and **color profile**.

Color Model

First, you need to be clear on which color models you're dealing with when working with images:

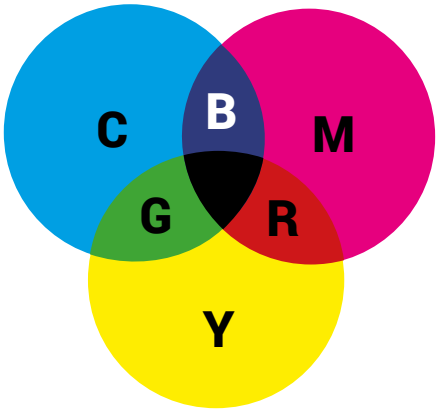
- Cameras and monitors use the **RGB model**, in which the color spectrum is made up of the light colors red, green, and blue according to the additive color model used with emissive color, such as light, and back-lit displays.
- When the images are printed, the model is less clear.

  A) The subtractive (reflective) CMY color model, along with the additional color black (CMYK), are used in offset printing. Black is added as a fourth color for a number of reasons, including cost savings.

  B) In a classic photo lab a color exposure is made onto light-sensitive photographic paper according to the rules of the additive color model.

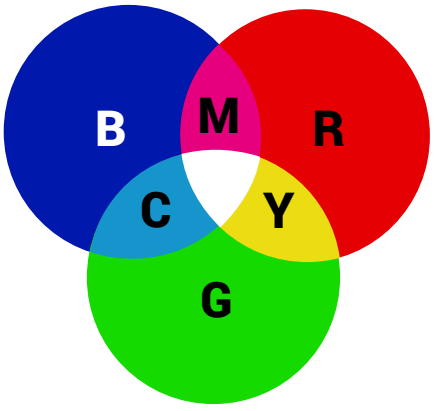
C) Inkjet printers are a hybrid. Although they work according to the subtractive color model inks, the process varies. Some printers use four colors, others six, others with eight or more. The image data for the output is therefore not prepared in CMYK, but in RGB.

A printer communicates in RGB, and only during the last step between the printer driver and printer automatically converts to device color channels. Such printers are designated as RGB printers even if they print using CMYK+ colors. Because we are primarily looking at the needs of photographers in this series of articles, we will focus on the RGB color workflow.



● Cyan ● Magenta ● Yellow

Cyan/magenta/yellow (CMY) are subtractive colors. They are the complementary colors to the additive colors of red/green/blue (RGB). All three colors combined together filter out all wavelengths of the visible spectrum, resulting in black. The principle of subtractive colors is all around us. A red cherry reflects mostly red wavelengths, and so appears red. Many colors in the visible spectrum can be emulated by mixing the three subtractive base colors. Using more saturated base colors, allows a wider range of target colors to be emulated.



● Red ● Green ● Blue

The additive color model rests on the primary colors red, green and blue (there is no functional color model based on red, yellow, and blue, despite what art instructors may say). The majority of visible colors can be created in RGB. All three combine to create white, as counterintuitive as that sounds.

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Adobe explains why color models are used in order to classify and qualify colors

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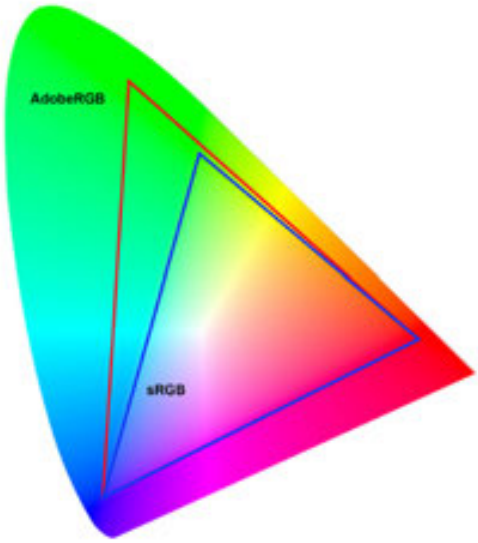
Color Space

It's important to note that an RGB color model can include most colors visible to the human eye. Cameras, monitors, inkjet printers and exposure devices can never reach all the colors of the visible color spectrum, only a subset. An RGB working space is specified in many imaging apps and defines the user's focus on a specific part of the whole RGB model. There are as several color workingspaces preinstalled in most apps, and more available for download. For photographic purposes, only two color working-spaces have seen wide use: sRGB and Adobe RGB. However, new color spaces like the eciRGBv2, LStar RGB, and Display P3 are finding their way into photography.

- The factory settings on entry-level digital cameras and phones often include only the "sRGB" color space. Anyone who using such cameras who processes their images on the computer, but later either prints them themselves, has them developed by a low-cost photo lab, and/or uploads them to the Internet is well served by the consistency and simplicity of an sRGB workflow.
- Owners of high-quality cameras can choose if they want to take their pictures in the (slightly smaller) sRGB color space or in AdobeRGB. If they have an option for AdobeRGB they should choose this color space as a workingspace in Photoshop. The basic rule is that when choosing your working space in Photoshop, orient yourself to the source color space of the input device. Anyone who works primarily as an image editor and deals a lot with outside data should also choose Adobe RGB as their working space.



TIP

Data not supplied in AdobeRGB should not automatically be converted into this color space upon opening, but be left in its original space and converted using Photoshop's Convert to Profile option, if conversion proves necessary.

The Adobe RGB and sRGB color spaces and their position within the CIE color diagram: The horseshoe-shaped boundry maps the human visual range.

Color Profile

The third area of color management is device color profiles. These have the task of balancing the color characteristics of an input or output device when conversions to or from another space are needed.

EXAMPLE

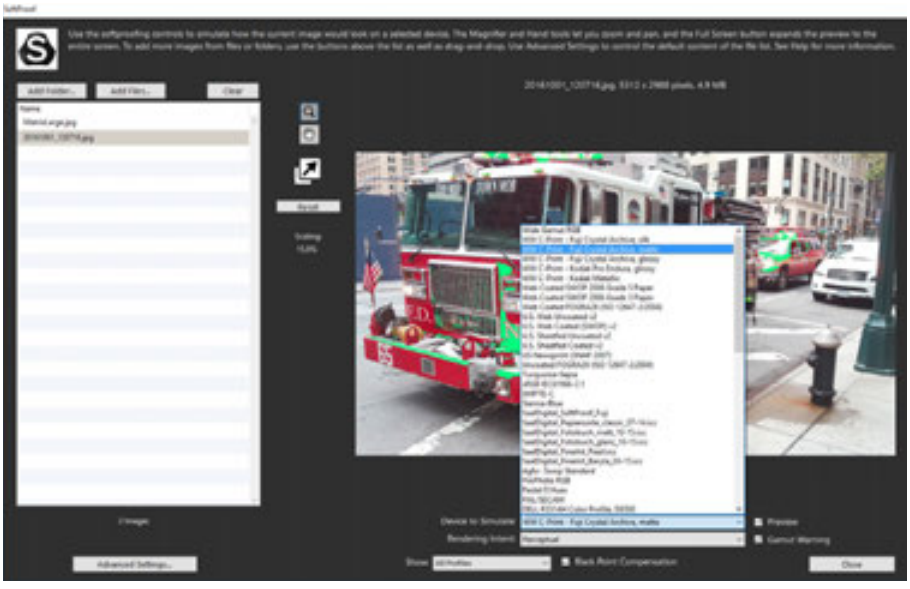
A monitor profile incorporates calibration for the RGB channels including white point, with device descriptions of gamma, whitepoint, and gamut . The color management of the operating system or the application leaves the calibration in place, and applies any needed corrections based on the device description. These color profiles are available to the operating system and can be managed by it. To access the profiles, apps typically use OS calls that supply them.

Inkjet printer data is left in the RGB color space. Multiple profiles are drawn up for these printers -- one for each combination of printer and paper. Those who do not use OEM inks, have even more need for custom profiles for each printer, ink, and paper combination. These profiles are managed by the OS. When it transmits the RGB data to the printer driver, the system applies the selected profile in order to optimize the color separation to the number of inks in that printer model.

TIP

Programs like Adobe Photoshop and Lightroom, as well as the Datacolor software upgrade Spyder5+, use printer color profiles in their soft proof feature and show an emulation of the print colors on screen.

For photos that are taken in RAW mode, it doesn't matter what color space is set in the camera. The application of a color space takes place only when processing the image in the RAW converter.



Spyder5+ soft proof with the color gamut warning activated. This indicates which colors from the original file are not within the printer gamut.

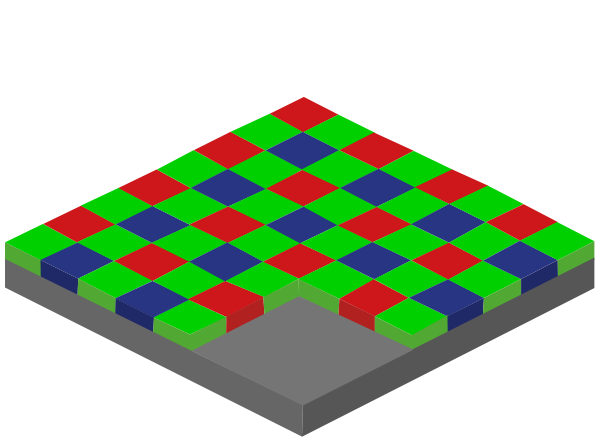
Photo in RAW Format

Why you should consider working with RAW data

INFO

RAW data or RAW files are recorded onto the storage medium in-camera with practically no in-camera processing.

RAW data is produced mostly on the basis of the Bayer pattern, which resembles a three-color checkerboard. Each CMOS sensor pixel features either a green, blue or red filter. The ratio here is typically 2 : 1 : 1. The Bayer pattern simulates the green-dominated color perception of the human eye.



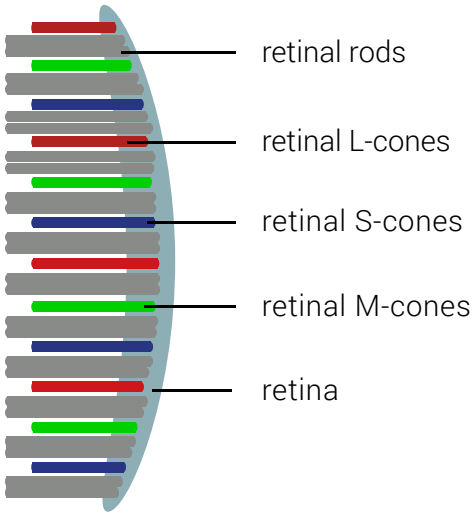


Diagram of a sensor as well as the retina of a human eye: The analogy between the CMOS sensor and retina is easy to spot. Both use the same “technology,” the same color model.

INTERESTING ONLINE FINDS

Should you be shooting in RAW? Read why Digital Photography School thinks you should

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Some photographers are still skeptical about working with RAW format and frequently pose arguments like:

- RAW data are larger than JPEGs, so fewer pictures fit on the memory card
- To use RAW formats, you must install additional software from the camera manufacturer onto the computer
- At first glance, RAW images often seem less sharp and unbalanced, compared to the automatically corrected images in JPEG format.

But many of these problems have solutions. For instance, a 32-gigabyte memory cards can be purchased for under $10US today, so space should no longer be considered a significant issue.

Current versions of Photoshop, as well as the sister applications Photoshop Elements and Photoshop Lightroom, support RAW files from almost all camera models. There are, of course, also special programs from camera manufacturers that include very powerful, workflow-oriented RAW converters, such as Capture One®, DxO® OpticsPro® or AfterShot Pro®.

Contrary to first impressions, you get better pictures from RAW data, though it may require more user adjustment. For this reason, photographers are increasingly interested in using “digital negatives”, as RAW is sometimes called.

“The discussion about whether you shoot better in RAW or JPEG, comes up repeatedly in the Photography Network/Nikon Community. We can see here that approximately 70% of our users are basically using the RAW format. Anyone who wants to get the most of his pictures, puts just as much emphasis on color management and calibration of monitor and camera as on the complete control of the individual image data processing steps provided by the RAW format. Arguments like “needs a lot of storage space” are obsolete in today’s world. And if time is a factor, e.g., to meet a deadline, most of our users choose the option that most cameras offer of saving RAW and JPEG at the same time. The benefits of the 12 to 16 bit color depth and greater exposure latitude in RAW shots compensate the bitter pill of time consuming processing work for the majority of our users.”

(Klaus Harms, editor of the Photography Network/Nikon Community)

The Properties of RAW Image Files

RAW, Optimized image before target conversion, JPEG, TIFF

RAW | Optimized image before target conversion | Output file formats

A RAW image file can seem brighter or darker, depending on the image, compared to an output format such as JPEG. The image is optimized either in the camera or after download, using a RAW converter, and eventually converted to the preferred output format.

What you should know about TIFFs, JPEGs and RAWS

To convert an image to common use formats such as JPEG or TIFF, a camera makes multiple correction calculations with its internal image processing after capture. These include:

- **TIFF** (Tagged Image File Format): This format has its origins in pre-press. It supports elements like the CMYK color space, and is able to save layers and offers lossless compression (LZW, ZIP). When converting into TIFF format, 12/16 or 32-bit color can be converted into 8-bit color. It can also be set as a standard format alongside PDF and EPS for the lossless storage of image data.
- **JPEG** (Joint Photographic Expert Group): JPEG compression is a compression method which, depending on the compression rate, can result in more or less lossy data compression all the way to visible data loss at high compression. This is not typically of any consequence in the case of lower compression, so the smaller file size wins out. This format is not recommended for anyone processing images, since every time an image is subsequently opened, processed and saved the compression algorithm and accompanying loss of quality occurs again. JPEG is also available in different color depths.

- **RAW:** Although the images are captured with the same camera, RAW photos provide more image data than JPEG or TIFF files. RAW images contain all the information recorded by the image sensor during the capture. RAWs are barely reprocessed in the camera. In comparison with a TIFF, they require relatively little storage space, because the information is stored according to the Bayer pattern of only one channel and not all three color channels. Thus a RAW file from a 20 megapixel CMOS chip takes up about 20 to 24 megabytes of memory, compared to the 60 megabytes of a later 8-bit TIFF (or 120 megabytes for a 16-bit file). All additional values, such as white balance, color correction or contrast enhancement, are stored with only in text format (EXIF information). With other capture systems without CMOS technology—such as the SuperCCDs from Fuji or the Foveon chips used in the Sigma DSLRs—the memory footprint of RAW photos is larger.

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SLR Lounge sheds some light on the merits of shooting RAW vs. JPEG

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EXPERT INSIGHT

Correction calculations made by the camera for JPEGs and TIFFs

White balance, exposure and sharpening are “baked” into these file formats. First an estimated white balance is applied. Then the software compensates for the Bayer interpolation softness. The color filters require two thirds of the image info to be interpolated. This plus low-pass filters lead to blurry contrast edges that need to be sharpened. So in the next step, the camera computes sharpened results. To make the images more appealing to the viewer, it also amplifies the contrast and increases the saturation. The weaker the electronic and optical camera components are, the more in-camera processing is required.

From the Image to the Workflow

How RAW files simplify your workflow

There is one key benefit of RAW files: When converting a RAW photo, the photographer can adjust almost all capture functions after-the-fact. The basic fundamental limits, such as the lighting, focal length, aperture or shutter speed, cannot be changed. But available correction options go far beyond what was formerly possible in the lab, or even is now possible from a “pre-baked” JPEG of TIFF. The photographer no longer has to go into the darkroom. Instead, they sit in a dimly lit editing space at a “light box”(i.e. a monitor) and “develop” different versions of a photograph with the aid of simple adjustment tools. This also applies for the other image formats, but not with as much latitude.

The RAW workflow of photo professionals: from exposure to output

Here is another application similar to the image sequence shown under “Properties of RAW”, extending the workflow to include printing. In addition to image optimization, many RAW converters have gained a variety of filters. Therefore, the boundaries between basic image adjustment and advanced editing are further blurred. If the work involves layers, masks or advanced retouching, as is often done in beauty photography, an image editor such as Photoshop is used, instead of a photo processing tool such as Lightrooom.

DOWNLOAD

Click here to download the reference images

Download >

The RAW Workflow of Photo Professionals

From exposure to output

1. Exposure in RAW format, without image optimization in RAW converter. RAW files usually appear less bright.

The RAW Workflow of Photo Professionals

From exposure to output

2a. Image optimized in RAW converter

The RAW Workflow of Photo Professionals

From exposure to output

2b. Alternatively: Advanced editing in Photoshop (subtle vignetting to support a more dramatic look) preferably using an uncompressed image format.

The RAW Workflow of Photo Professionals

From exposure to output

3a. Conversion into a JPEG at a high compression rate with clearly visible posterization (also known as banding)

The RAW Workflow of Photo Professionals

From exposure to output

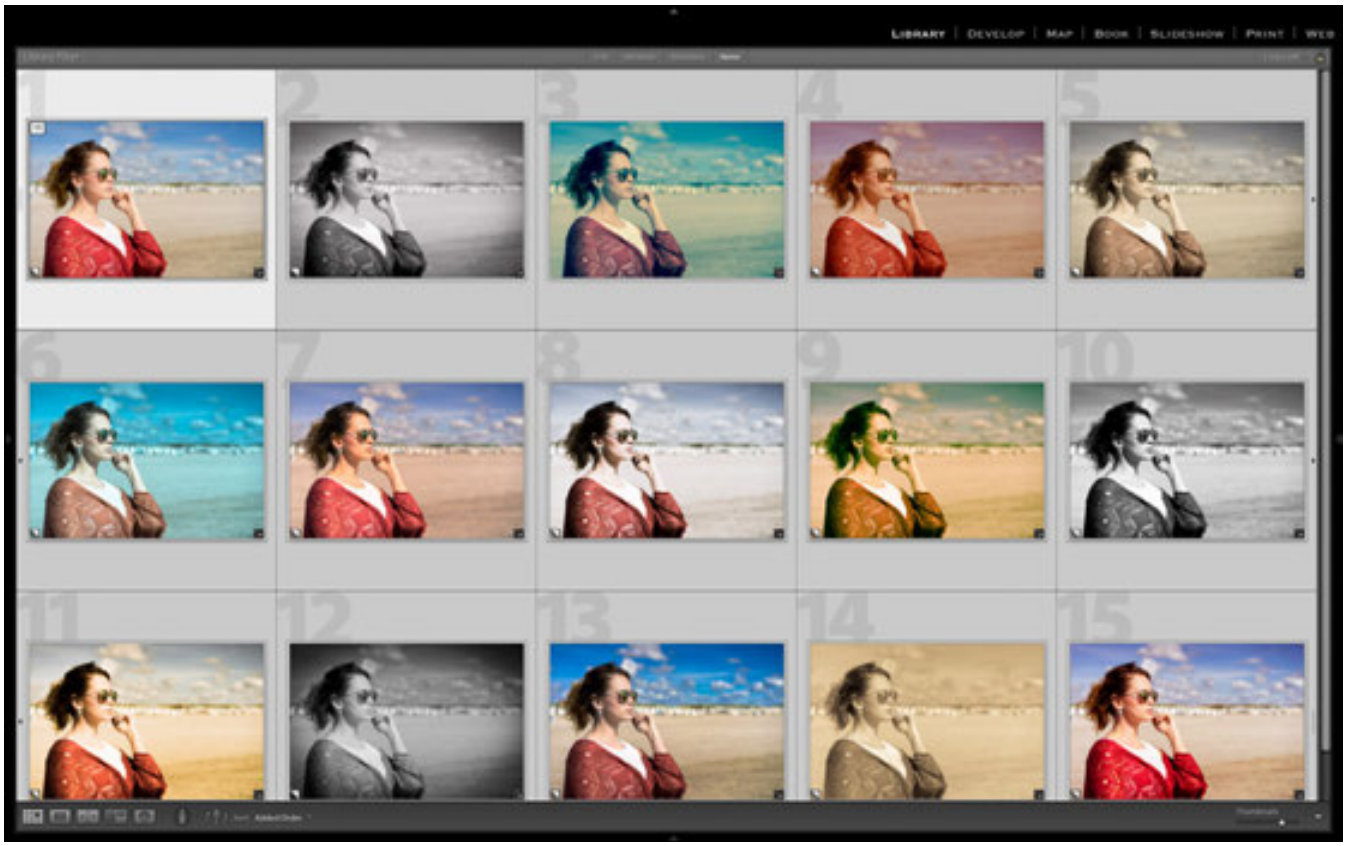
3b. Image optimized for printing. The colors now appear less bright and saturated due to conversion to the printer's smaller color space.

RAW files offer old-school photographers some pleasant secondary aspects

- The RAW format cannot be overwritten. Parameter settings can be changed, but the setting changes do not affect the underlying picture information. This property stops the RAW file from being inadvertently changed, reduced or damaged by repeated compression. Thus the nickname: digital negative.
- You can make various “prints” from the original — just like when using film. Image versions are created depending on the intended use: for output at a lab, an inkjet printer, on use on the Internet, for offset printing, or further processing in Photoshop. A master version, with dust-busting, cropping, and global corrections can be saved, prior to the creation of the various output versions.
- Some RAW converters, such as the programs Capture One and Lightroom, combine this “photo development” with an image management system that radically simplifies the management of prints. The results can be read in a single operation from the camera or memory card, renamed, cropped and labeled according to IPTC conventions. You can also convert them into different target formats and scales, tune the resolution and color depth for output, add ICC color space information, sort them directly into subdirectories and/or add a watermark. All of this works with single images and with batch-mode.

INFO

Since Photoshop CS4, in combination with the file manager Adobe Bridge, you can achieve almost the same functionality as Capture One or Lightroom, though in a less intuitive format.



Working with camera RAW formats not only benefits image quality, but also allows you to create multiple versions of a photo—like here in Lightroom 6 — from an image without taking up extra disk space. These “virtual copies” are saved in your Lightroom catalog and not in the RAW properties of the image.

Benefits for Photographers

How photographers benefit from working with RAW data

Photographers with a high-volume of images can benefit from these workflows in several ways:

- They retain maximum control over the manner that their image is tuned. This is much like a specialty lab in which one works with a very capable lab assistant—only without any loss of time and communication problems.
- With special functions, you can also reduce color noise, compensate for chromatic aberration, remove lens vignetting, and apply color corrections.
- The shots from a job can be converted into different TIFF versions with just a few clicks.
- If you want to create JPEG previews at the same time for your customers, you can send them directly via e-mail or upload to a website.
  There is also the option to save conversion profiles for use on similar capture subjects. Such profiles are useful, for example, for studio photographers. They ensure uniformly warm skin tones in portrait series or optimize the color of tabletop structures that are always shot in similar lighting conditions.
- There is another advantage for photographers who are interested in pure image optimization: they can tune their photos via a clearly laid out and functional interface without having to become a Photoshop expert. In Photoshop's Camera Raw, Lightroom, and other RAW converters, you will find all essential settings to control the tonal values, the sharpness and the colors of your images accurately and quickly.

TIP

The RAW workflow can be precisely tailored to your individual needs. This is easy if you invest a little time in getting to know the technology and are open to experimenting.

Benefits for Graphic Designers

How RAW technology improves work in the creative field

Image editors in design fields shift the creative aspects from the capture to the post-production process. This means they photograph individual items for later composite images, rather than single image use. As the quality of output images is not as important for them as for the photographer, JPEG photos are often used as working material. After all, they have the technical know-how to hide image weaknesses with just a few clicks.

What they need first and foremost is a well-tagged image database so that they can quickly find montage elements. The working files are then simply managed in a project folder at system level. Creative photographers, therefore, do not benefit as much from the advantages of RAW technology as the optimization-oriented photographers, although working with RAW data does have some advantages for them:

- The most fundamental of these is the superior quality. When comparing two normally exposed and unmodified shots, there may be little difference to be seen; but as soon as you start to adjust the image you are confronted with “artifacts” that come from the JPEG compression. During compositing, montage items almost always need to be adjusted or matched in terms of color and light, thus the increased adaptability that RAW images offer is significant. Stepping back to the RAW file, readjusting, and exporting a new version that meets the project need allows this.

- Application areas that offer functions in the range of image optimization and creative image editing are very useful: RAW converters are well suited for black and white conversion of color images. Color corrections that relate to the whole image are often easier to control with RAW adjustments than with editing tools. Anyone who works with the Photoshop converters Camera Raw or Lightroom can also use the tools to subtly manipulate the mood of his images with artificial edge shading.

INTERESTING ONLINE FINDS

PetaPixel offers the top eight reasons you should shoot in JPEG

More Info

Problem Areas

The nuances of working with RAW data

RAW is not in a consistent format, but rather is a generic name. It has nothing to do with Adobe DNG, but is simply the native format for each camera make and model. These formats were not originally intended for end users, though over time, this has become a common function, so newer RAW formats are more adaptable.

If you work with the current version of Photoshop or Lightroom, you will receive support for most current and older cameras' RAW formats automatically. So opening RAW files is not problematic for today's image editing programs; as long as the program version is newer than the camera.

DNG (Digital Negative)

Alternative format for proprietary standards

INFO

Digital negative (extension: DNG) refers to a different kind of RAW image format, developed by Adobe. This open format's goal is to to avoid storing images in proprietary file formats of individual camera manufacturers and gradually establish a uniform standard that all manufacturers can resort to.

RAW data can be converted to the DNG standard using Adobe's free DNG Converter and then opened in older versions of editing apps. So one use for DNG, is to launder newer RAW camera files into older imaging software that does not support them. However, with Adobe's subscription model, fewer users find themselves in this bind, since they receive software updates as part of the subscription.

At present, each camera manufacturer is still developing its own format, which may even differ between camera models. As a result, the approach involving a uniform standard is a good one. In practice, however, a few manufacturers have implemented the in-camera DNG but have not done it fully. This means that proprietary formats may have advantages over DNG converted files. Be careful when converting files to DNG format, to be sure all your data is captured. DNG use has not become a standard, or even common at the camera level, and is actually less popular today then when first released. Test DNG as a workflow before committing to it, to be sure it meets your particular needs.

In 2003, the Photoshop RAW plug-in made it possible for the first time to edit many popular RAW formats in a fast, comfortable, and option-rich interface. Today, RAW converters are widely available with frequent improvements to their capabilities.

INTERESTING ONLINE FINDS

PhotoUp provides an interesting comparison of the various file formats that can be used

More Info >

Glossary

AdobeRGB (1998):
The AdobeRGB color space was specified by Adobe in 1998. The objective was to create a color space from which the CMYK color space of a color printer could be adapted to the RGB color space of a monitor. It is larger than the sRGB color space.

Bayer filter:
Photo sensor named after its inventor Bryce E. Bayer. The sensor is overlaid with green, blue and red filters, which are in a ratio of 50 % green, 25 % blue and 25 % red. In this way, it approximates the sensitivity of the human eye, in which green accounts for the greatest share of the perception of brightness.

Border shadowing:
See objective vignetting.

CCFL display:
This is a first generation flat screen. CCFL stands for Cold Cathode Fluorescent Lamp. In contrast to today's monitors, which are illuminated with LEDs, the CCFL displays produce light using neon tubes.

Cd/Candela:
Candela is the SI unit of the SI basic variable of luminosity.

CEPS tools:
CEPS stands for Color Electronic Page Setting. In photography, this involves photo retouching or photo editing with the aid of image editing programs such as Adobe Photoshop or Adobe Lightroom.

CIE-xy color space:
The CIE standard valence system has been defined by the International Commission on Illumination (Commission internationale de léclairage). It is the link between human perception and physical causes.

CMOS technology:
CMOS stands for Complementary Metal Oxide Semiconductor. This involves semi-conductor technology, which has become widespread in photo sensors, etc. CMOS sensors are primarily characterized by low power consumption and short switching times.

Color balance:
The color balance determines the ratio of the colors to each other. For example, if the colors in a recorded image are not reproduced as they are in the original, the colors are not in balance.

Color fidelity:
Color fidelity is the measure of the deviation or the similarity of colors during recording and output. Color management systems are normally used to achieve maximum color fidelity.

Color fringes:
Color fringes, also called chromatic aberrations, occur in images because of deviations of optical lenses. Because the individual wavelengths of the visible spectrum in a lens are refracted differently, each wavelength range has its own focal point. In practice, this leads to color fringes, which are particularly visible on the contours and edges of an image. This error can be corrected using additional lenses, which are attuned to the respective wavelengths.

Color homogeneity:
The color homogeneity describes the color consistency or the color deviations from a set point over an area, e.g. the surface of a display. In the case of poor color homogeneity, the same color value is reproduced differently on the surface of the display. For example, this could cause a green tint on the upper right and a red tint on the bottom left corner.

Color noise:
Color noise, or image noise, describes the deterioration of image quality due to structures, which themselves do not carry any image information. The impacted image sections deviate from the actual image information in terms of color and brightness, and are especially visible in dark areas of the image in which the signal-to-noise ratio is very low.

Color separation:
In the prepress stage, this means the conversion of the colors of a wide variety of image datasets, mostly to the CMYK color model. The colors are separated into the print colors cyan, magenta, yellow and black.

Color space:
A color space is a defined range of colors. The best-known color spaces from the RGB color model are sRGB and AdobeRGB (1998), as well as the CMYK color model, Euroscale Coated v2, Fogra39 and ISO Coated v2.

Color temperature:
The color temperature describes the light mood and is specified in Kelvin. A cooler light mood (bluish) prevails, for example, in a cloudy sky, than in sunshine (yellowish).

Contrast:
Contrast is the ratio of the brightest to the darkest area of an image.

Contrast balance:
Is the ratio of the brightest and darkest areas and defines from where the light is being drawn.

Cross-effect:
The cross-effect originally came from analogue photography, in which a slide film was combined with a negative development process or a negative film with a reverse development. The colors are artificial and the contrasts are higher. This effect is often used for artistic styling and is imitated today by digital techniques.

Contrast ratio:
See contrast.

DLP projector:
DLP stands for Digital Light Processing and it is a technology developed by Texas Instruments where the image is created by an array of micro mirrors within the optical path. A special feature is that the red, green and blue pixels are not generated simultaneously (as in LCD projectors), but quick alternate flashing through a rotating color filter wheel.

Glossary

ECI RGB:
The ECI (European Color Initiative) RGB is a standardized RGB color space, which covers a large part of the printing processes, as well as all currently known display technologies. Thus, it is a color space that is designed especially for the needs of the graphic arts and prepress.

eciRGBv2:
Further development of ECI RGB. It has been optimized in terms of the visual equidistance, as is known from the CIE-L a*b* color space. This results in a minimization of banding and clipping errors, as with the L-Star color space. The ECI recommends using the color space as early as data creation, for example when converting RAW data or 16-bit material to 8-bit color depth.

EXIF information:
The Exchangeable Image File Format (EXIF) is a standard format for saving metadata in digital images. EXIF information can be, among other things, a camera model, shutter speed, ISO value, aperture or date and is written to the header of the image file.

Fine Art Printer:
There is no uniform definition for the term Fine Art Printing. All Fine Art printers attempt to create an image which most closely resembles a one-of-a-kind or work of art, in terms of its properties, selected motif, and post-editing, and in the use of the best photographic materials.

Gamma:
In relation to a monitor, gamma refers to the modulation of an input signal to a desired output signal. In practice, this means that a low-contrast image is obtained by correction of the output signal to contrast.

Gamut:
Is the description of the color range which can be reproduced by a technology or a technical device.

Gray balance:
"Achromatic" colors are the gray shades that lie between white and black. These are produced by equal proportions of the respective primary colors such as cyan, magenta and yellow (CMY) in the print or red, green, blue (RGB) in self-luminaires. If the primary colors change to equal proportions, a gray may become brighter or darker, but remains neutral gray. If the color components are no longer in the same proportion, one can immediately perceive a gray tint and gray balance is no longer maintained.

High-Key Image:
In high-key photography bright tones, few contrasts and soft light lend style to an image.

ICC profile:
An ICC profile describes the color space of input and output devices such as printers, scanners, digital cameras or monitors and refers to the reference values.

IPTC conventions:
IPTC is the acronym for International Press Telecommunications Council. As per the IPTC convention, metadata is saved to the header of an image file for improved classification. The metadata contains such things as parameters such as file format, file size, filename, height and width in pixels of a file, date recorded and the description of the contents.

Kelvin:
Kelvin is an SI unit of temperature measurement. It is also used for measuring the color temperature.

L*a*b* color space:
Is a device-independent color space and describes all perceivable colors equally, so that color deviations can be described by a Delta E.

LCD:
This refers to Liquid Crystal Display. The liquid crystals regulate the light impermeability per color channel. LED monitors are also LC displays, but irradiate the color filters from the rear with LEDs instead of fluorescent tubes.

LCD projectors:
The white light of the projector lamp is split into 3 basic colors by a prism and then sent through 3 LC displays, which control the image information per color channel. Subsequently, the image is put together by another prism. LCD projectors are characterized by a smaller contrast range, but can reproduce the colors very differently.

Low-pass filter:
With image files, so-called Moiré effects may occur instead of very fine recurring structures, which are at the limit of the sensor's resolution. These small, colored structures have a specific pattern, but are not part of the image information. Low-pass filters are used to prevent these phenomena.

L-Star RGB:
A modern color space, which combines the advantages of a higher color resolving power of the human visual sense of the CIE-LAB color space with the usual RGB color spaces like AdobeRGB and ECI-RGB. Banding and color tipper errors are reduced to a minimum when viewed on a display and in printing.

Luminance:
The luminance describes the brightness of image points
Luminance homogeneity:
Describes uniformity of brightness for a defined area. A poor luminance homogeneity of a monitor can be seen as vignetting, although all image areas must be equally bright.

LookUp table:
IT term. LookUp table (also called LUT) are tables in which application-specific values are stored which are used in a program routine.

Glossary

LUT:
See LookUp table.

Luv color space:
A color space that is calculated from the CIE-XY system, similar to the L*a*b* color space. This system is mainly used for the evaluation of light sources or monitors.

LED backlight:
This refers to a flat radiator that consists of many light emitting diodes and is used for the background lighting of an LED display.

Low-Key image:
In contrast to high-key photography, low-key photography uses little light as a stylistic device. Light is used consciously to accentuate highlight contours and the few details that are important for the image. Many sections of the image often remain in the dark. This lends a certain amount of drama to this type of image, a familiar sight in theatrical or stage photography.

Objective vignetting:
Vignetting refers to the shadowing of the image to its borders, which can be highlighted by components of the objective, such as lens mounts, and by filters or lens hoods. The effect itself is originally unwanted, but it is also used as a stylistic device.

Offset printing:
A printing method, in which the pressure roller does not directly contact the printed product, but the printing is transferred indirectly by a rubber roll. This is the most common method for printing books, newspapers, and packaging.

OSD:
Stands for On Screen Display and describes an input menu window of a monitor, which is shown on the display.

Primary colors:
Primary colors are the basic colors that compose secondary colors. Thus, the colors that a monitor can display are composed of the colors red, green and blue. The same applies to cyan/magenta/yellow, by means of which all colors which can be displayed by the process are mixed in printing.

Polarization layer:
A polarization layer, as used in LE and LC displays, ensures that light is polarized, which means only the fractions that oscillate in a plane are transmitted. This is the prerequisite for the option of regulating the light quantity per pixel with LCs.

Reflection idiosyncrasies:
Printing paper and photo paper have a large number of surface properties. The bandwidth ranges from matte and glossy to a wide variety of textures and materials. Every surface and material has very specific characteristics, with regard to how they absorb and reflect light. These must be taken into consideration when setting up a color workflow.

Rendering Intent:
The way in which the colors must be converted from one color model into another.

Softproof:
In a softproof, the colors on a monitor are simulated as they will appear on the selected output material. Also know as ink color simulation.

sRGB:
Standard RGB is also a color space developed by Hewlett-Packard and Microsoft. It is widespread, but smaller than the AdobeRGB (1998) color space.

THM file:
THM files are miniature view video files, which are used to create a thumbnail image (miniature image) of the video file for improved orientation.

Tonal value:
The tonal value describes the measure of tone scales. For example, a digital camera with 8 bits per color channel has a tonal value reduction of 28 = 256 steps per color channel.

White balance:
In the case of a white balance, a camera should be set to the color temperature of the recorded scene to keep the color balance neutral. This is also done by the human eye, which evaluates colors in a largely neutral manner.

White luminance:
White luminance is the maximum brightness of a white point that can be displayed by a monitor.

White point:
The white point defines the white of a monitor with full control.

Wide gamut:
Gamut is the displayable color space of a monitor. Wide gamut features a device class that is characterized by a very large color space that is close to AdobeRGB (1998) or even slightly more. Monitors with wide gamut are typically used in image editing.

Workflow:
A workflow in photography includes all devices and technologies, which are used in the processing of the final image. A typical workflow includes a digital camera, image editing software, display units/monitors, and printers.

Spyder5 eBook

Color Management Can Be Easy

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